Neuroethics, Theology, and ADHD: A Christian Response to Ethical Dilemmas Surrounding the Neuroscience and Treatment of Attention Deficit Hyperactivity Disorder in Children and Adolescents

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Introduction

Journey with me for a moment to an American elementary school classroom, perhaps even your own 1st or 2nd grade classroom. Look around at the 20 children in the room and the teacher up front charged with their well-being and education; 2 children in the class have a mental disorder that will affect their lives in ways they can only begin to understand. Let's select one of those children and take a closer look into their life. Little Mary has always been a fun-loving outgoing girl who loves jungle gyms and crafts. She is her parents' first child so when she starts displaying behavioral issues, they assume that Mary is "going through a difficult phase" or that parenting toddlers/preschoolers is more difficult than they'd imagined. At a parent-teacher conference last year, Mary's kindergarten teacher brought up that Mary seemed to have trouble focusing in the classroom. Her parents brought this up at Mary's next checkup at her pediatrician and soon after were faced with referrals, testing, and ultimately an ADHD diagnosis. They did what most parents do in this situation and proceeded with a stimulant prescription from the pediatrician. After many years of trying different stimulants and doses for months at a time, Mary's parents settle on one that seems to work well for her with minimal side effects. Fast forward now to high school. Mary has become more aware of the effects of her ADHD, especially seen in the shift in priorities, focus-ability, and emotions when she takes her medication compared to days she does not. Medication brings Mary undeniable productivity, often at the expense of her enjoyment of life and her ability to interact socially as she normally would. On non-medicated days she feels more fully herself, but can only barely manage the minimum of productivity and focus required by school.

Attention-Deficit/Hyperactivity Disorder (ADHD) affects 10.2% of children in the

USA, and a general average of around 5% of children globally (Carolan 2022). Not only is 1 in every 10 kids in the US affected, but for each child diagnosed with ADHD there are 1-2 parents or guardians impacted as well as a myriad of teachers, siblings, and friends. As Christians we have a call during our time in this fallen and disordered world, namely to love the Lord with all our hearts, souls, minds, and strengths, and to love our neighbor as ourselves (Luke 10:25-27). Given that ADHD has such a prevalent impact on our neighbors in society, it requires some attention and consideration from the Church.

As we will see momentarily, ADHD is a very complex and multifaceted disorder. There is some consensus on certain core behavioral symptoms, but often the effects stretch far beyond these standardized symptoms. Every bit of research is contested or debated, from the neurobiology to the causes and risk factors to the treatment and management. Once we delve into the realm of treating mental disorders, particularly in minors, there are a plethora of ethical issues that are raised, some of which are explored in this paper. Also part of the discussion are the impacts on and influence of parenting, friendships, and society. When we factor in the Christian belief that all this discussion is taking place on an earth riddled by Sin and by spiritual warfare against an enemy with solely ill intentions, the conversation becomes all the more dire; a battle is being fought for every heart and mind around us. So in the discussion of this complex mental disorder, let us proceed with concern for our neighbor and with wisdom, which ultimately comes from fearing the Lord (Psalm 111:10). In order to utilize wisdom, we must first familiarize ourselves with what is known on the subject of ADHD.

Attention-Deficit Hyperactivity Disorder

In the past hundred years, science has witnessed the discovery, and rise of what we currently call ADHD. There was some early mention of a "disease of attention" with mental restlessness and an inability to keep the mind from straying by physicians around 1800, but only relatively recently did this translate to clinical study (CHADD 2018). From the 1960's until the 1990's medical interest in ADHD was largely confined to North America, but the past 30 years have seen globalization into both European and South American contexts, likely due to the rise of internet technology (Conrad and Bergey 2014). In recent years, social media content about ADHD has increased to the level of what some would even call a trend. While some question its legitimacy altogether, there is a general consensus that it is indeed a valid mental disorder, but more on that later (Quinn and Lynch 2016).

Symptoms

Psychiatry has, over time, compiled a list of 18 core ADHD symptoms, divided by the Diagnostic and Statistical Manual of Mental Disorders (DSM5) into 2 major categories: inattention and impulsivity-hyperactivity. Inattention symptoms include: "fails to give close attention to details or makes careless mistakes", "difficulty sustaining attention in tasks or play activity", "reluctance to engage in tasks that require sustained mental effort (such as schoolwork or homework)", "does not seem to listen when spoken to directly" because the mind is elsewhere, "easily distracted by extraneous stimuli", "often does not follow through on instructions and fails to finish schoolwork, chores or duties in the workplace", difficulty organizing tasks, frequently losing things necessary for activities, and forgetfulness (DSM5 quoted by Ringeisen et al. 2016.). The 9 symptoms associated with hyperactivity-impulsivity are: "often fidgets with or taps hands or feet

or squirms in seat", "often leaves seat in situations when remaining seated is expected", "often runs about or climbs in situations where it is inappropriate (Note: in adolescents or adults, may be limited to feeling restless)", "often unable to play or take part in leisure activities quietly", "is often "on the go" acting as if "driven by a motor""... or "uncomfortable being still for extended time", "often talks excessively", "often blurts out answers before questions have been completed", "often has difficulty awaiting turn", and "often interrupts or intrudes on others" (DSM5 quoted by Ringeisen et al. 2016).

Diagnosis

Diagnosis of ADHD usually flows (or ought to) from this fairly standardized list of symptoms. A child is diagnosed with ADHD if 6 of the 18 core symptoms have persisted for 6 months to a greater degree than is developmentally expected and impact social and academic activities (DSM5 quoted by Ringeisen et al. 2016.). Some additional caveats purported by the CDC include: several symptoms must be present before the age of 12, symptoms must clearly interfere with daily life, and symptoms cannot be better explained by any other mental disorder (CDC 2022). In the past, the term ADD referred to inattentive-type ADHD, but it is now recognized under DSM5 as the same disorder and the term is no longer used (Rodgers 2022). However, those with ADHD still can present Predominantly Inattentive, Predominantly Hyperactive-Impulsive, or Combination-type (CDC 2022).

While this diagnostic standard seems fairly clear-cut, there is much subjectivity involved. First of all, the diagnosing is being done by various medical professionals who are each interpreting reported behavioral symptoms; where human interpretation is involved there is room for error (Parens and Johnston 2009). Since there is no way to draw a clear line between those who do and don't have ADHD, there is an inevitable zone of ambiguity (Parens and Johnston 2009). There is also a difference in symptom expression as well as diagnostic prevalence between boys and girls, with a 3:1 ratio of boys to girls diagnosed (Carolan 2022). Closely related to these issues is the consideration that some symptoms can simply be the result of parenting differences; the child who leaves their seat in class may have ADHD, or simply may not have been taught to obey their teachers. One final difficulty is that there is one simple diagnosis to encapsulate ~$8x10^{16}$ possible combinations of 6 symptoms, not to mention the fact that each symptom occurs along a spectrum of intensity (Parens and Johnston 2009). There have been attempts at using objective tests, such as neurophysiology and neuroimaging, to test for ADHD, but none have proven reliable (Wolraich 2019).

Legitimacy

As I mentioned earlier there is some debate about whether ADHD truly exists. In their discussion of this question Quinn and Lynch (2016) quote a book entitled *"The ADHD Fraud: How Psychiatry Makes "Patients" of Normal Children"*, published in 2006 by neurologist Fred Baughman. The primary argument of such critics is that we as a society diagnose and medicate kids who are difficult to maintain in classroom settings, assuming that they have some neurological chemical imbalance. The goal and outcome of ADHD treatment then is to make the difficult child more compliant via drugging. Baughman argues that ADHD is a disorder we have manufactured to fit our time and is a "quick catch-all" allowing for a "magic bullet treatment" (Quinn and Lynch 2016). Parents of children with ADHD would likely press back against his idea that ADHD symptoms are reserved to the

classroom. The DSM symptoms listed above do look at children's behavior through the lens of a school-setting, but this likely reflects the fact that school is often the first focused environment an attention-deficit child is placed in rather than the belief that ADHD symptoms are virtually all related to classroom behavior, as Baughman claims. Classrooms also have teachers who might be able to better recognize abnormal behaviors which parents have accepted as normal for their child; that is to say, symptoms are often noticeable long before the child reaches school-age, but no one is going to diagnose a 2-year-old with ADHD because they 'squirm in their seat' or 'lose things necessary for tasks'.

Another critique of ADHD is made clear in Diller's 1998 book entitled "*Running on Ritalin: A Physician Reflects on Children, Society, and Performance in a Pill*". Such critics argue that the ADHD label allows patients to "blame their behavior… on brain functioning or genetics, rather than accepting personal responsibility for their problems" (Quinn and Lynch 2016). This critique also ties in our cultural emphasis (over-emphasis perhaps) on performance and efficiency. In light of this, ADHD is then a social construct and its treatment is nothing more than a medicinal performance enhancer for those who fail to perform at the level of their peers. While these critiques of the existence of ADHD are not generally seen as true, they do raise some valid concerns which will be addressed in the discussion of ADHD treatment.

Neurobiology

A look into the neuroanatomy and neurophysiology of brains with ADHD compared to those without the disorder provides strong evidence that ADHD is indeed a 'real' mental condition. In very general terms, ADHD was thought to be the result of low levels of norepinephrine (NE) in the brain, though this is an incomplete picture of the complexity that is ADHD. While there is no one underlying neurotransmitter or systemic failure, a few considerations can help us build an idea of the ADHD brain.

The Locus Coeruleus (LC), or "blue spot", nucleus in the brainstem is the primary source of NE in the brain and is historically understood to release NE in response to arousal (i.e. in response to thoughts, emotions, external stimuli, etc.) (Aston-Jones and Cohen 2005). The LC operates in 2 modes: phasic and tonic. Phasic mode involves a widespread rapid release of NE and allows the brain to concentrate on the task at hand; the tonic mode involves a baseline release of NE and allows the brain to disengage from the current task and observe the environment for a task that proves more beneficial or useful at the time (Aston-Jones and Cohen 2005 & Vazey 2018). The delicate balance between these two LC states of NE release is crucial for normal brain function and performance but is impaired in ADHD (Howells et al. 2012). The brains of those with ADHD operate in a continual state of "hypoarousal" as the tonic baseline release of NE happens at a lower frequency than normal (i.e. a release NE frequency of <1-3Hz); consequently, the phasic mode is unable to maintain signals and the result is decreased arousal of the cortex and a deficit in attentional abilities (Howells et al. 2012). One study of mice discovered that genetic knockout of an intracellular signaling enzyme in LC caused behavior comparable to ADHD (D'Andrea 2015). This aspect of ADHD only explains the handful of ADHD symptoms pertaining to sustained attention, though. Equally complex systems, that are equally sensitive to the slightest dysregulation, are found all throughout the brain.

Dopamine (DA) release is also thought to be implicated in ADHD. There are numerous models and theories as to how this might play out (Rege 2022), but there are a few basic principles. In general, brains with ADHD are found to have lower levels of DA than in those without ADHD; this is associated with sadness, lack of motivation, sleepiness, mood swings, memory loss, and problems sleeping and concentrating (Benisek 2022). This might be caused by high levels of DA transporters which clear DA from the brain too quickly (Benisek 2022). Attention is thought to be maintained by DA release in anticipation of reward, but in ADHD there is a delayed DA release, only after the reward and not in anticipation of it (Rege 2022). Other ADHD DA issues include: lower baseline DA in reward pathways, less DA released in response to actual rewards, a greater emphasis on immediate rewards than delayed rewards, and less ability to learn via conditioning/reinforcement (Rege 2022). The theories surrounding these lower levels of DA are too complicated for the purpose of this paper and ultimately are still undergoing research (Rege 2022).

The structure and function of numerous other brain regions were found to be implicated with the introduction of neuroimaging techniques; such brain regions include the prefrontal cortex (cognitive control in response to dopamine), the thalamus (sensation relay station), the amygdala (fear processing), and the cerebellum (coordination and motor control) (Kasparek et al 2013). The anterior cingulate and orbitofrontal cortices process stimuli for decision-making and directly control LC activity, but do not function optimally in ADHD (Aston-Jones and Cohen 2005; Kasparek et al 2013). One key feature of neurons is their ability to change (termed *neuronal plasticity*) under the regulation of the dopaminergic system, but this too is altered in ADHD; this is likely the underlying cause of the more widespread issues of brain form and function (Kasparek 2013). In EEG measurements of cumulative brain activity, those with ADHD display a higher prevalence of theta (slow) waves and lower prevalence/intensity of beta (fast, thinking) waves than normal brains (Cortese 2012).

Ultimately ADHD is far more complex than we know. The above explanation of the LC function is simplified from much research and even then is only a part of the vast interconnected web of abnormalities of the ADHD brain. Zooming in, brain abnormalities are largely the result of genetic variation and the influence of the environment of genes (Cortese 2012). Zooming out, the behaviors resulting from brain dysfunction vary greatly and are influenced heavily by one's environment. On an even more large scale level, our behaviors have the capacity to be shaped by the indwelling of the Holy Spirit. In every level of consideration, from genes to brain structure to social interaction, the disorder that we characterize as ADHD varies by person, as is true with any mental disease or disorder. For the Christian, this unfathomable complexity serves as a reminder that we indeed are not omniscient, but that we serve a God who is.

Treatment of ADHD

When it comes to the treatment of this complicated mental disorder there are two general options: medication and behavioral therapy. The medication route involves the use of a stimulant taken orally. The stimulant Ritalin, or methylphenidate which is related to amphetamines, was first released in 1955 and then took off as the primary response to ADHD (Miller and Leger 2003). Since then numerous other stimulants have been released by various companies, all containing some level of

methylphenidate or amphetamine. Behavioral therapy for ADHD has two components: "parent training" and executive function training (Miller 2022). This usually includes sessions with a therapist and shifts made in the child's environment both at home and school (Parens and Johnston 2009), basically all with the goal of teaching the child to live a functional life.

A large randomized clinical study conducted over 14 months looked at the multiple treatment modes of children with ADHD; it was thus referred to as the Multimodal Treatment Study of Children with ADHD, or "MTA" (MTA Coop 1999). This was the first long-term comparison of pharmacotherapy to behavioral therapy. In the study 500+ children with ADHD between the ages of 7-10 were placed in one of 4 groups: intensive behavioral treatment, medicinal management, a combination of the 2, or standard care by medical providers in their communities. They concluded that their specifically crafted concoction of stimulants was the ultimate treatment for ADHD, outpacing any efforts of behavioral therapy or combined treatment. Parens and Johnston (2009) question this conclusion and ask what influence the pharmaceutical industry might have had in this conclusion (Parens and Johnston 2009). This same article points out that in the subsequent years following the MTA study the researchers followed up on the participants and their results were different than initially reported. At the 2-year mark following the end of the 14 months subjects who were assigned to intensive behavioral therapy while on a low dose of stimulant fared just as well as those who had relied solely on the stimulant concoction (Parens and Johnston 2009).

This skepticism of a pharmacological approach to ADHD is further amplified by research done into the negative aspects of stimulants. In a study performed with preschool-aged children with ADHD, research found that preschoolers on stimulants grew an average of 1.2 cm less per year than controls (Swanson 2006). Another consideration is the negative side effects stimulants have on daily activities critical to life; some such effects are insomnia and a decrease in appetite (Connor 2006). There is also the concern for the potential development of Substance Use Disorders (Carolan 2022). Ultimately, much more research is required on the effects of stimulants, particularly on the long-term effects on the developing brains of the ever-younger children to which they are prescribed (Parens and Johnston 2009).

One practical consideration in the discussion of treatment is the cost, both financially and temporally. Both behavioral and medicinal treatment cost time and money to the patient or the patient's parents. Stimulants prescribed by a medical provider are typically covered by medical insurance, despite a rather large copay that still falls on the patient. This is all assuming that the patient has access to a primary care physician and medical insurance, which are far from guaranteed in our present society. The benefit to stimulants, though, is that once an effective dose is established for each individual, symptom management is as quick and simple as taking a pill every morning. Behavioral therapy has been shown to produce long-term changes that last the individual long after the treatment itself (Parens and Johnston 2009). The benefit here is that the treatment remains effective even after the time has been spent and money has been paid, as opposed to medicines that are only effective when in the patient's system. One issue with this though is the time it takes out of the week; additionally, this takes the cooperation of school teachers as well as insurance companies. Behavioral therapy can also be combined with a stimulant as we saw above

in the MTA trial. This option often proves to be cost-effective in that behavioral therapy provides long-term symptom management, while stimulants serve as a supplement in lower, thus cheaper, doses (Parens and Johnston 2009).

A Christian Evaluation of ADHD Treatment

The Christian response to the above issues is as multifaceted as the problems themselves. One issue that faces Christians in medicine from time to time is the claim that various interventions are a means of "playing God" or replacing God by using earthly things to alter our biology; surely Christians ought to simply pray enough and a miraculous healing will occur, right? John Piper has a beautifully succinct response to this in a short video responding to Christian use of antidepressants, which we can easily apply to the conversation of ADHD treatment. He says that "God has ordained physical means"; in the same way that God has ordained water and sleep and food to sustain us and point us to Him, He can use medicine to bring healing (Piper 2010). As humans we are mortal beings who are inherently dependent; this was true even of Adam and Eve before the Fall. We were created as embodied creatures designed to rely on God through interaction with the earth He built for us. Thus, on principle, there is no issue with Christian reliance on medical practices, so long as we see them as an outworking of God's compassion and grace.

In regard to the use of stimulants to manage the symptoms, a portion of the scientific community still remains skeptical (reviewed: Parens and Johnston 2009). This skepticism is echoed in the Christian call to think critically seen throughout Scripture. In multiple places the Church is encouraged to use discernment and wisdom (Philippians 1:9, Proverbs 9:10). In a list of closing remarks to the church in Thessalonica Paul urges them to "test all things" and "hold fast to what is good" (1 Thessalonians 5:21). In the original context this likely refers to a vigilant awareness of teachers preaching false doctrine, however the same principle can apply to ways we interact with things we face in our lives. We are to be thoughtful and prudent people who give thought to our steps, not simple fools who believe everything (Proverbs 14:15). John Piper does this in his address on antidepressants. He points out that dealing with the mind is a very difficult and tricky thing. His response to medication, then, is that we should not necessarily rush to it as our first line of defense to alter our mental state and that it instead should be treated with caution.

During His earthly ministry God promised us that while on earth we would face suffering (John 16:33). God has graciously provided some means of comfort via relief from earthly remedies, but there is no magic pill that will perfectly re-order what Sin has disordered. In this world we will never plumb the depths of our insufficiency, fallenness, and dependence on Christ, but in this weak state God's power is made perfect and complete in us. For about 10% of the population this weakness, or thorn in the flesh as Paul calls it, is the complex brain misordering known as ADHD. The effects of the Fall and of a limited mortal weak state are just as prevalent in the other 90%, though, just in other ways.

So what of the treatment of ADHD? Perhaps a Christian response is one that utilizes community and therapy through behavioral therapy. This has been shown to have long-lasting effective results and is a valid treatment for many ADHD patients (Parens and Johnston 2009). Or maybe treatment looks like the use of stimulants, using moderation and caution, with the attitude that they are a gift from God that He

can use to restore dysfunctional parts of the brain. Ultimately the treatment of ADHD is up to the discernment of the diagnosed individual or their parents if the child is too young to understand their condition. To handle the difficult considerations that come with an ADHD diagnosis, the only truly wise option is to prayerfully seek God and His will in it all.

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